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EXAMINER

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GROUP 2800

**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/918,853
Filing Date: July 30, 2001
Appellant(s): VYVODA ET AL.

MAILED
FEB 13 2006
GROUP 2800

Pamela J. Squyers
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 15 December 2005 appealing from the Office action mailed 14 December 2004.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 113 – 117, 119, 122 – 124, 126, 128, 130 – 132, 134 – 136, 137 – 140, 142 – 145
and 147 – 153 are rejected under 35 U.S.C. 102(e) as being ^{anticipated} by Thomas, Michael (U. S. patent 6,509,283 B1).

In re claim 113, Thomas in the U. S. patent 6,509,283 B1; figures 1 – 4 and related text, discloses, exposing an oxidizable surface to an oxidizing plasma, wherein the oxidizing plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface;

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and regulating the oxidizing plasma activity to limit a rate of formation of the oxide film (Column 3).

In re claim 114, Thomas discloses wherein regulating the oxidizing plasma activity includes bombarding the oxidizable surface with energized ions prior to exposing the oxidizable surface to the oxidizing plasma (Column 1).

In re claim 115, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to remove contaminants from the oxidizable surface (Column 1).

In re claim 116, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to remove other oxide layer present on the oxidizable surface (Column 1).

In re claim 117, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to facet the oxidizing surface (Column 1).

In re claim 119, Thomas discloses wherein regulating the oxidizing plasma activity includes diluting the oxidizing plasma with an inert gas (Column 2).

In re claim 122, Thomas discloses providing a plasma chamber; placing a substrate in the plasma chamber; and igniting the oxidizing plasma after placing the substrate in the plasma chamber (Figure 3).

In re claim 123, Thomas discloses further includes igniting an inert gas plasma prior to igniting the oxidizing plasma (Figure 3).

In re claim 124, Thomas discloses further including placing the oxidizable surface in the inert gas plasma (Figure 3).

In re claim 126, Thomas discloses wherein the oxidizable surface includes silicon (Figure 1).

In re claim 128, Thomas discloses wherein exposing an oxidizable surface to an oxidizing plasma includes exposing the oxidizable surface to a plasma including oxygen (Figure 3).

In re claim 130, Thomas discloses forming a semiconductor layer; exposing the semiconductor layer to a plasma including oxygen, wherein the plasma has an activity relative to the semiconductor layer; forming an oxide film on the semiconductor layer; and regulating the plasma activity to limit a rate formation of the oxide film (Column 3).

In re claim 131, Thomas discloses wherein the step of forming a semiconductor layer includes forming a doped semiconductor layer (Figure 1).

In re claim 132, Thomas discloses wherein the step of forming a semiconductor layer includes forming a silicon layer (Figure 1).

In re claim 134, Thomas discloses further including an electrically conductive layer prior to forming the semiconductor layer (Column 1).

In re claim 135, Thomas discloses wherein the oxide film includes a gate oxide layer (Column 1).

In re claim 136, Thomas discloses wherein the oxide film includes a passivation layer (Column1).

In re claim 137, Thomas discloses exposing an oxidizable surface to a plasma including an oxygen species and a nitrogen species, wherein the plasma has an activity relative to the oxidizable surface; forming an oxynitride film on the oxidizable surface; and regulating the plasma activity to limit a rate of formation of the oxynitride film (Abstract and Figure 3).

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In re claim 138, Thomas discloses wherein the nitrogen species includes a compound selected from the group consisting of nitrogen, ammonia and nitrous oxide (Figure 3).

In re claim 139, Thomas discloses wherein the step of forming an oxynitride film includes a gate oxide layer (Figure 1).

In re claim 140, Thomas discloses wherein the step of forming an oxynitride film includes a passivation layer (Figure 1).

In re claim 142, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma including an oxygen species and a nitrogen species (Figure 3).

In re claim 143, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Figure 3).

In re claim 144, Thomas discloses exposing an oxidizable surface to a plasma including oxygen, wherein the plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface; regulating the plasma activity to limit a rate of formation of the oxide film; and forming a silicon nitride layer overlying the oxide film (Column 3).

In re claim 145, Thomas discloses wherein the step of forming a silicon nitride layer includes plasma deposition of silicon nitride (Column 3).

In re claim 147, Thomas discloses further including subjecting the oxidizable surface to a plasma containing nitrogen species prior to exposing the oxidizable surface to a plasma including oxygen (Column 3).

In re claim 148, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

In re claim 149, Thomas discloses exposing an oxidizable surface to a plasma including an oxygen species, wherein the plasma has an activity relative to the oxidizable surface; forming an oxide film having an upper surface on the oxidizable surface; regulating the plasma activity to limit a rate of formation of the oxide film; and forming an oxynitride region at the upper surface of the oxide film (Column 3).

In re claim 150, Thomas discloses wherein the step of forming an oxynitride region includes subjecting the oxide film to plasma containing a nitrogen plasma (Column 3).

In re claim 151, Thomas discloses wherein subjecting the oxide film to a plasma containing nitrogen species includes subjecting the oxide film to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

In re claim 152, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma including oxygen (Column 3).

In re claim 153, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 118, 121, 125 and 129 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 113 – 117, 119, 122 – 124, 126, 128, 130 – 132, 134 – 136, 137 – 140, 142 – 145 and 147 – 153 above, and further in view of Kwan et al. (U. S. patent 6,335,288 B1).

In re claims 118 and 129, Thomas does not teach wherein bombarding the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage.

However, Kwan in the U. S. patent 6,335,288 B1; figures 1A – 3 and related text, discloses bombarding the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage since the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to bombard the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage, in the invention of Thomas, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 121, Thomas does not teach wherein regulating the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface.

However, Kwan discloses regulating the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface, since; the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the +surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface, in the invention of Thomas, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 125, Thomas does not teach further including providing a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level.

Kwan discloses providing a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level, since; the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level, in the

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invention of Thomas, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

Claim 120 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 113 – 117, 119, 122 – 124, 126, 128, 130 – 132, 134 – 136, 137 – 140, 142 – 145 and 147 – 153 above, and further in view of Denison et al. (U. S. patent 5,869,149).

In re claim 120, Thomas discloses further including providing a substrate having a back surface opposite a face surface, wherein the oxidizable surface includes at least a portion of the face surface.

Thomas does not disclose wherein regulating the oxidizing plasma activity includes contacting the back surface with a cooling medium.

Denison in the U. S. patent 5,869,149; figures 1 – 6 and related text, discloses contacting the back surface with a cooling medium to prevent a rise in temperature of the substrate due to the plasma action (Column 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to contact the back surface with a cooling medium in the invention of Thomas, since, according to Denison, prevents a rise in temperature of the substrate due to the plasma action.

Claims 127 and 141 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 113 – 117, 119, 122 – 124, 126, 128, 130 – 132, 134 – 136, 137 –

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140, 142 – 145 and 147 – 153 above, and further in view of Cleeves et al. (U. S. patent 6,541,312 B2).

In re claims 127 and 141, Thomas does not disclose wherein the oxidizable surface includes a semiconductor element of an antifuse device.

However, Cleeves in the U. S. patent 6,541,312 B2; figures 1 – 16B and related text discloses that oxide layers can be antifuse devices (Column 10).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form an antifuse device in the invention of Thomas, since as disclosed by Cleeves, antifuse devices can be formed with oxides.

Claim 146 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 113 – 117, 119, 122 – 124, 126, 128, 130 – 132, 134 – 136, 137 – 140, 142 – 145 and 147 – 153 above, and further in view of Kawakami et al. (U. S. patent 6,399,520 B1).

Thomas does not disclose wherein the step of forming a silicon nitride layer includes chemical vapor deposition of silicon nitride.

However, Kawakami in the U. S. patent 6,399,520 B1; figures 1A – 14 and related text, discloses that a high quality SiN layer can be formed, in a short time by CVD method (Column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a silicon nitride layer includes chemical vapor deposition of silicon nitride, in the invention of Thomas, since, according to Kawakami, a high quality SiN layer can be formed, in a short time by CVD method.

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Claim 133 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 113 – 117, 119, 122 – 124, 126, 128, 130 – 132, 134 – 136, 137 – 140, 142 – 145 and 147 – 153 above.

Thomas does not show wherein the step of forming a semiconductor layer includes forming a germanium layer.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to exchange silicon with germanium since it is well known in the art that germanium is a formidable semiconductor material and silicon and germanium are art recognized equivalent for the disclose intended purposes. Also, it has been held to be within the general skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. *In re Leshin*, 125 USPQ 416.

Claims 1 – 5, 7, 10 – 12, 14, 16, 18 – 20, 22 – 24, 35, 38 – 40, 55 – 58, 60 – 63 and 65 – 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Moon et al. (US 2002/0137266 A1).

In re claim 1, Thomas in the U. S. patent 6,509,283 B1; figures 1 – 4 and related text, discloses, exposing an oxidizable surface to an oxidizing plasma, wherein the oxidizing plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface; and regulating the oxidizing plasma activity to limit a rate of formation of the oxide film (Column 3).

Thomas does not show wherein the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma.

However, Moon, in the U.S. Patent Application Publication US 2002/0137266 A1; figures 1 – 8 and related text, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film, since, as taught by Moon, an oxide layer will not grow substantially beyond an initial exposure time.

In re claim 2, Thomas discloses wherein regulating the oxidizing plasma activity includes bombarding the oxidizable surface with energized ions prior to exposing the oxidizable surface to the oxidizing plasma (Column 1).

In re claim 3, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to remove contaminants from the oxidizable surface (Column 1).

In re claim 4, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to remove other oxide layer present on the oxidizable surface (Column 1).

In re claim 5, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to facet the oxidizing surface (Column 1).

In re claim 7, Thomas discloses wherein regulating the oxidizing plasma activity includes diluting the oxidizing plasma with an inert gas (Column 2).

In re claim 10, Thomas discloses providing a plasma chamber; placing a substrate in the plasma chamber; and igniting the oxidizing plasma after placing the substrate in the plasma chamber (Figure 3).

In re claim 11, Thomas discloses further includes igniting an inert gas plasma prior to igniting the oxidizing plasma (Figure 3).

In re claim 12, Thomas discloses further including placing the oxidizable surface in the inert gas plasma (Figure 3).

In re claim 14, Thomas discloses wherein the oxidizable surface includes silicon (Figure 1).

In re claim 16, Thomas discloses wherein exposing an oxidizable surface to an oxidizing plasma includes exposing the oxidizable surface to a plasma including oxygen (Figure 3).

In re claim 18, Thomas discloses forming a semiconductor layer; exposing the semiconductor layer to a plasma including oxygen, wherein the plasma has an activity relative to the semiconductor layer; forming an oxide film on the semiconductor layer; and regulating the plasma activity to limit a rate formation of the oxide film (Column 3).

Thomas does not show wherein the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma.

However, Moon, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film, since, as taught by Moon, an oxide layer will not grow substantially beyond an initial exposure time.

In re claim 19, Thomas discloses wherein the step of forming a semiconductor layer includes forming a doped semiconductor layer (Figure 1).

In re claim 20, Thomas discloses wherein the step of forming a semiconductor layer includes forming a silicon layer (Figure 1).

In re claim 22, Thomas discloses further including an electrically conductive layer prior to forming the semiconductor layer (Column 1).

In re claim 23, Thomas discloses wherein the oxide film includes a gate oxide layer (Column 1).

In re claim 24, Thomas discloses wherein the oxide film includes a passivation layer (Column1).

In re claim 35, Thomas discloses exposing an oxidizable surface to a plasma oxidation process for an initial exposure time; and growing an oxide film on the oxidizable surface, and wherein the plasma process is configured such that the oxide film grows to a predetermined thickness substantially independent of an exposure time beyond the initial exposure time (Column 3).

Thomas does not show wherein the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film.

However, Moon, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film, since, as taught by Moon, an oxide layer will not grow substantially beyond an initial exposure time.

In re claim 38, Thomas discloses wherein the plasma oxide process includes generating a plasma includes oxygen and an inert gas (Figure 3).

In re claim 39, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma oxidation process (Figure 3).

In re claim 40, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Figure 3).

In re claim 55, Thomas discloses exposing an oxidizable surface to a plasma including an oxygen species and a nitrogen species, wherein the plasma has an activity relative to the

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oxidizable surface; forming an oxynitride film on the oxidizable surface; and regulating the plasma activity to limit a rate of formation of the oxynitride film (Abstract and Figure 3).

Thomas does not show wherein the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma.

However, Moon, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film, since, as taught by Moon, an oxide layer will not grow substantially beyond an initial exposure time.

In re claim 56, Thomas discloses wherein the nitrogen species includes a compound selected from the group consisting of nitrogen, ammonia and nitrous oxide (Figure 3).

In re claim 57, Thomas discloses wherein the step of forming an oxynitride film includes a gate oxide layer (Figure 1).

In re claim 58, Thomas discloses wherein the step of forming an oxynitride film includes a passivation layer (Figure 1).

In re claim 60, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma including an oxygen species and a nitrogen species (Figure 3).

In re claim 61, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Figure 3).

In re claim 62, Thomas discloses exposing an oxidizable surface to a plasma including oxygen, wherein the plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface; regulating the plasma activity to limit a rate of formation of the oxide film; and forming a silicon nitride layer overlying the oxide film (Column 3).

Thomas does not show wherein the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma.

However, Moon, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film, since, as taught by Moon, an oxide layer will not grow substantially beyond an initial exposure time.

In re claim 63, Thomas discloses wherein the step of forming a silicon nitride layer includes plasma deposition of silicon nitride (Column 3).

In re claim 65, Thomas discloses further including subjecting the oxidizable surface to a plasma containing nitrogen species prior to exposing the oxidizable surface to a plasma including oxygen (Column 3).

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In re claim 66, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

In re claim 67, Thomas discloses exposing an oxidizable surface to a plasma including an oxygen species, wherein the plasma has an activity relative to the oxidizable surface; forming an oxide film having an upper surface on the oxidizable surface; regulating the plasma activity to limit a rate of formation of the oxide film; and forming an oxynitride region at the upper surface of the oxide film (Column 3).

Thomas does not show wherein the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma.

However, Moon, discloses that an oxide layer will not increase substantially beyond an initial exposure time (Figure 6).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the oxide film grows to a predetermined thickness at an end of an initial exposure time to the oxidizing plasma, and wherein additional exposure to the oxidizing plasma beyond the initial exposure time does not result in a significant further increase in thickness of the oxide film, since, as taught by Moon, an oxide layer will not grow substantially beyond an initial exposure time.

In re claim 68, Thomas discloses wherein the step of forming an oxynitride region includes subjecting the oxide film to a plasma containing a nitrogen plasma (Column 3).

In re claim 69, Thomas discloses wherein subjecting the oxide film to a plasma containing nitrogen species includes subjecting the oxide film to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

In re claim 70, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma including oxygen (Column 3).

In re claim 71, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

Claims 6, 9, 13, 17 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Moon as applied to claims 1 – 5, 7, 10 – 12, 14, 16, 18 – 20, 22 – 24, 35, 38 – 40, 55 – 58, 60 – 63 and 65 – 71 above, and further in view of Kwan.

In re claims 6 and 17, Thomas in view of Moon does not teach wherein bombarding the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage.

However, Kwan discloses bombarding the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage since the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to bombard the oxidizable surface with energized ions includes subjecting

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the oxidizable surface to a bias voltage, in the invention of Thomas in view of Moon, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 9, Thomas in view of Moon does not teach wherein regulating the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface.

However, Kwan discloses regulating the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface, since; the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface, in the invention of Thomas in view Moon, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 13, Thomas in view of Moon does not teach further including providing a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level.

Kwan discloses providing a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level, since; the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level, in the invention of Thomas in view of Moon, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 37, Thomas in view of Moon does not disclose wherein the plasma oxidation process includes applying RF bias voltage to the oxidizable surface.

However, Kwan discloses wherein the plasma oxidation process includes applying RF bias voltage to the oxidizable surface, since; the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to applying RF bias voltage to the oxidizable surface in the invention of Thomas in view of Moon, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

Claims 8 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Moon as applied to claims 1 – 5, 7, 10 – 12, 14, 16, 18 – 20, 22, 23, 24, 35, 38 – 40, 55 – 58, 60 – 63 and 65 – 71 above, and further in view of Denison et al.

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In re claims 8 and 36, Thomas discloses further including providing a substrate having a back surface opposite a face surface, wherein the oxidizable surface includes at least a portion of the face surface.

Thomas in view of Moon does not disclose wherein regulating the oxidizing plasma activity includes contacting the back surface with a cooling medium.

Denison discloses contacting the back surface with a cooling medium to prevent a rise in temperature of the substrate due to the plasma action (Column 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to contact the back surface with a cooling medium in the invention of Thomas in view of Moon, since, according to Denison, prevents a rise in temperature of the substrate due to the plasma action.

Claims 15 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Moon as applied to claims 1 – 5, 7, 10 – 12, 14, 16, 18 – 20, 22, 23, 24, 35, 38 – 40, 55 – 58, 60 – 63 and 65 – 71 above, and further in view of Cleeves et al.

In re claims 15 and 59, Thomas in view of Moon does not disclose wherein the oxidizable surface includes a semiconductor element of an antifuse device.

However, Cleeves discloses that oxide layers can be antifuse devices (Column 10).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form an antifuse device in the invention of Thomas in view Moon, since as disclosed by Cleeves, antifuse devices can be formed with oxides.

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Claim 64 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Moon as applied to claims 1 – 5, 7, 10 – 12, 14, 16, 18 – 20, 22, 23, 24, 35, 38 – 40, 55 – 58, 60 – 63 and 65 – 71 above, and further in view of Kawakami et al.

Thomas in view of Moon does not disclose wherein the step of forming a silicon nitride layer includes chemical vapor deposition of silicon nitride.

However, Kawakami discloses that a high quality SiN layer can be formed, in a short time by CVD method (Column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a silicon nitride layer includes chemical vapor deposition of silicon nitride, in the invention of Thomas in view of Moon, since, according to Kawakami, a high quality SiN layer can be formed, in a short time by CVD method.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Moon as applied to claims 1 – 5, 7, 10 – 12, 14, 16, 18 – 20, 22, 23, 24, 35, 38 – 40, 55 – 58, 60 – 63 and 65 – 71 above.

In re claim 21, Thomas in view of Moon does not show wherein the step of forming a semiconductor layer includes forming a germanium layer.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to exchange silicon with germanium since it is well known in the art that germanium is a formidable semiconductor material and silicon and germanium are art recognized equivalent for the disclose intended purposes. Also, it has been held to be within the general

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skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. *In re Leshin*, 125 USPQ 416.

Claims 72 – 76, 78, 81 – 83, 85, 87, 89 – 91, 93 – 99, 101 – 104 and 106 – 112 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Chung et l. (U. S. patent 5,930,650).

In re claim 72, Thomas in the U. S. patent 6,509,283 B1; figures 1 – 4 and related text, discloses, exposing an oxidizable surface to an oxidizing plasma, wherein the oxidizing plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface; and regulating the oxidizing plasma activity to limit a rate of formation of the oxide film (Column 3).

However, Thomas does not disclose regulating at least one of the following: reaction kinetics, growth initiation, and surface energy.

Chung in the U. S. patent 5,930,650; figures 1 – 6 and related text discloses that reaction kinetics is a process variable of a reaction process (column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate at least one of the following: reaction kinetics, growth initiation and surface energy in the invention of Thomas, since as taught by Chung, reaction kinetics is a process variable and discovering the optimum or workable ranges requires only routine experimentation.

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In re claim 73, Thomas discloses wherein regulating the oxidizing plasma activity includes bombarding the oxidizable surface with energized ions prior to exposing the oxidizable surface to the oxidizing plasma (Column 1).

In re claim 74, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to remove contaminants from the oxidizable surface (Column 1).

In re claim 75, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to remove other oxide layer present on the oxidizable surface (Column 1).

In re claim 76, Thomas discloses wherein bombarding the oxidizable surface includes bombarding the oxidizable surface to facet the oxidizing surface (Column 1).

In re claim 78, Thomas discloses wherein regulating the oxidizing plasma activity includes diluting the oxidizing plasma with an inert gas (Column 2).

In re claim 81, Thomas discloses providing a plasma chamber; placing a substrate in the plasma chamber; and igniting the oxidizing plasma after placing the substrate in the plasma chamber (Figure 3).

In re claim 82, Thomas discloses further includes igniting an inert gas plasma prior to igniting the oxidizing plasma (Figure 3).

In re claim 83, Thomas discloses further including placing the oxidizable surface in the inert gas plasma (Figure 3).

In re claim 85, Thomas discloses wherein the oxidizable surface includes silicon (Figure 1).

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In re claim 87, Thomas discloses wherein exposing an oxidizable surface to an oxidizing plasma includes exposing the oxidizable surface to a plasma including oxygen (Figure 3).

In re claim 89, Thomas discloses forming a semiconductor layer; exposing the semiconductor layer to a plasma including oxygen, wherein the plasma has an activity relative to the semiconductor layer; forming an oxide film on the semiconductor layer; and regulating the plasma activity to limit a rate formation of the oxide film (Column 3).

However, Thomas does not disclose regulating at least one of the following: reaction kinetics, growth initiation, and surface energy.

Chung discloses that reaction kinetics is a process variable of a reaction process (column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate at least one of the following: reaction kinetics, growth initiation and surface energy in the invention of Thomas, since as taught by Chung, reaction kinetics is a process variable and discovering the optimum or workable ranges requires only routine experimentation.

In re claim 90, Thomas discloses wherein the step of forming a semiconductor layer includes forming a doped semiconductor layer (Figure 1).

In re claim 91, Thomas discloses wherein the step of forming a semiconductor layer includes forming a silicon layer (Figure 1).

In re claim 93, Thomas discloses further including an electrically conductive layer prior to forming the semiconductor layer (Column 1).

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In re claim 94, Thomas discloses wherein the oxide film includes a gate oxide layer (Column 1).

In re claim 95, Thomas discloses wherein the oxide film includes a passivation layer (Column 1).

In re claim 96, Thomas discloses exposing an oxidizable surface to a plasma including an oxygen species and a nitrogen species, wherein the plasma has an activity relative to the oxidizable surface; forming an oxynitride film on the oxidizable surface; and regulating the plasma activity to limit a rate of formation of the oxynitride film (Abstract and Figure 3).

However, Thomas does not disclose regulating at least one of the following: reaction kinetics, growth initiation, and surface energy.

Chung discloses that reaction kinetics is a process variable of a reaction process (column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate at least one of the following: reaction kinetics, growth initiation and surface energy in the invention of Thomas, since as taught by Chung, reaction kinetics is a process variable and discovering the optimum or workable ranges requires only routine experimentation.

In re claim 97, Thomas discloses wherein the nitrogen species includes a compound selected from the group consisting of nitrogen, ammonia and nitrous oxide (Figure 3).

In re claim 98, Thomas discloses wherein the step of forming an oxynitride film includes a gate oxide layer (Figure 1).

In re claim 99, Thomas discloses wherein the step of forming an oxynitride film includes a passivation layer (Figure 1).

In re claim 101, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma including an oxygen species and a nitrogen species (Figure 3).

In re claim 102, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Figure 3).

In re claim 103, Thomas discloses exposing an oxidizable surface to a plasma including oxygen, wherein the plasma has an activity relative to the oxidizable surface; forming an oxide film on the oxidizable surface; regulating the plasma activity to limit a rate of formation of the oxide film; and forming a silicon nitride layer overlying the oxide film (Column 3).

However, Thomas does not disclose regulating at least one of the following: reaction kinetics, growth initiation, and surface energy.

Chung discloses that reaction kinetics is a process variable of a reaction process (column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate at least one of the following: reaction kinetics, growth initiation and surface energy in the invention of Thomas, since as taught by Chung, reaction kinetics is a process variable and discovering the optimum or workable ranges requires only routine experimentation.

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In re claim 104, Thomas discloses wherein the step of forming a silicon nitride layer includes plasma deposition of silicon nitride (Column 3).

In re claim 106, Thomas discloses further including subjecting the oxidizable surface to a plasma containing nitrogen species prior to exposing the oxidizable surface to a plasma including oxygen (Column 3).

In re claim 107, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

In re claim 108, Thomas discloses exposing an oxidizable surface to a plasma including an oxygen species, wherein the plasma has an activity relative to the oxidizable surface; forming an oxide film having an upper surface on the oxidizable surface; regulating the plasma activity to limit a rate of formation of the oxide film; and forming an oxynitride region at the upper surface of the oxide film (Column 3).

However, Thomas does not disclose regulating at least one of the following: reaction kinetics, growth initiation, and surface energy.

Chung discloses that reaction kinetics is a process variable of a reaction process (column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate at least one of the following: reaction kinetics, growth initiation and surface energy in the invention of Thomas, since as taught by Chung, reaction kinetics is a process variable and discovering the optimum or workable ranges requires only routine experimentation.

In re claim 109, Thomas discloses wherein the step of forming an oxynitride region includes subjecting the oxide film to a plasma containing a nitrogen plasma (Column 3).

In re claim 110, Thomas discloses wherein subjecting the oxide film to a plasma containing nitrogen species includes subjecting the oxide film to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

In re claim 111, Thomas discloses further including subjecting the oxidizable surface to a plasma containing a nitrogen species prior to exposing the oxidizable surface to a plasma including oxygen (Column 3).

In re claim 112, Thomas discloses wherein subjecting the oxidizable surface to a plasma containing a nitrogen species includes subjecting the oxidizable surface to a plasma formed by a gas selected from the group consisting of nitrogen, nitrous oxide and ammonia (Column 3).

Claims 77, 80, 84 and 88 rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Chung as applied to claims 72 – 76, 78, 81 – 83, 85, 87, 89 – 91, 93 – 99, 101 – 104 and 106 – 112 above, and further in view of Kwan.

In re claims 77 and 88, Thomas in view of Chung does not teach wherein bombarding the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage.

However, Kwan discloses bombarding the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage since the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to bombard the oxidizable surface with energized ions includes subjecting the oxidizable surface to a bias voltage, in the invention of Thomas in view of Chung, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 80, Thomas in view of Chung does not teach wherein regulating the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface.

However, Kwan discloses regulating the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface, since; the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the +surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to regulate the oxidizing plasma activity includes applying an RF bias voltage to the oxidizable surface, in the invention of Thomas in view of Kwan, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

In re claim 84, Thomas in view of Chung does not teach further including providing a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level.

Kwan discloses providing a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level, since;

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the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate (Column 5).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a plasma power source having an output power, and wherein regulating the oxide plasma includes limiting the output power to a predetermined level, in the invention of Thomas, since, according to Kwan, the bias plasma serves to enhance the transport of plasma species (i.e. ions) created by the plasma source system to the surface of the substrate.

Claim 79 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Chung as applied to claims 72 – 76, 78, 81 – 83, 85, 87, 89 – 91, 93 – 99, 101 – 104 and 106 – 112 above, and further in view of Denison et al.

Thomas discloses further including providing a substrate having a back surface opposite a face surface, wherein the oxidizable surface includes at least a portion of the face surface.

Thomas in view of Chung does not disclose wherein regulating the oxidizing plasma activity includes contacting the back surface with a cooling medium.

Denison discloses contacting the back surface with a cooling medium to prevent a rise in temperature of the substrate due to the plasma action (Column 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to contact the back surface with a cooling medium in the invention of Thomas in view of Chung, since, according to Denison, prevents a rise in temperature of the substrate due to the plasma action.

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Claims 86 and 100 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas as applied to claims 72 – 76, 78, 81 – 83, 85, 87, 89 – 91, 93 – 99, 101 – 104 and 106 – 112 above, and further in view of Cleeves et al.

In re claims 86 and 100, Thomas in view of Chung does not disclose wherein the oxidizable surface includes a semiconductor element of an antifuse device.

However, Cleeves discloses that oxide layers can be antifuse devices (Column 10).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form an antifuse device in the invention of Thomas, since as disclosed by Cleeves, antifuse devices can be formed with oxides.

Claim 105 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Chung as applied to claims 72 – 76, 78, 81 – 83, 85, 87, 89 – 91, 93 – 99, 101 – 104 and 106 – 112 above, and further in view of Kawakami et al.

Thomas in view of Chung does not disclose wherein the step of forming a silicon nitride layer includes chemical vapor deposition of silicon nitride.

However, Kawakami discloses that a high quality SiN layer can be formed, in a short time by CVD method (Column 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a silicon nitride layer includes chemical vapor deposition of silicon nitride, in the invention of Thomas in view of Chung, since, according to Kawakami, a high quality SiN layer can be formed, in a short time by CVD method.

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Claim 92 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas in view of Chung as applied to claims 72 – 76, 78, 81 – 83, 85, 87, 89 – 91, 93 – 99, 101 – 104 and 106 – 112 above.

Thomas in view of Chung does not show wherein the step of forming a semiconductor layer includes forming a germanium layer.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to exchange silicon with germanium since it is well known in the art that germanium is a formidable semiconductor material and silicon and germanium are art recognized equivalent for the disclose intended purposes. Also, it has been held to be within the general skill of a worker in the art to select a known material on the base of its suitability, for its intended use involves only ordinary skill in the art. *In re Leshin*, 125 USPQ 416.

(10) Response to Argument

Appellant's arguments filed 15 December 2005 have been fully considered but they are not persuasive for the following reasons.

Appellant argues that Thomas does not teach plasma oxidation. Appellant argues that plasma oxidation occurs at temperatures below 600 °C with an ionized gas and that Thomas' oxidation occurs at 1000 °C with atomic oxygen.

Examiner respectfully submits that Thomas produces an ionized gas and that the oxidation takes place at 500 °C, which is within the range of “below 600 °C.” First, Thomas in column 2, lines 40 – 55 discloses the following:

The furnace is then pre-heated so that the silicon substrate is heated to a first temperature, for example 500° C, in the presence of the inert gas. The presence of the inert gas

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substantially inhibits oxidation of the silicon substrate during the pre-heating step. Atomic oxygen is then generated within the furnace by passing oxygen gas through the ceramic material. Optionally, a mixture of oxygen and nitrogen gas can be passed through the ceramic to generate atomic oxygen and atomic nitrogen. Simultaneously with the introduction of the oxygen gas, the ceramic material is heated to a second temperature, for example 1000° C that is greater than the first temperature. The passing of the oxygen gas through the heated ceramic material generates atomic oxygen that then reacts with the silicon substrate to form a layer of silicon dioxide on the surface of the substrate.

In the above mentioned passage, clearly Thomas teaches that the substrate is heated to a temperature of 500 °C and the ceramic material, not the substrate, is heated to a temperature of 1000 °C to generate atomic oxygen, which then reacts with the silicon substrate. Evidence that the atomic oxygen (O[•]) disclosed by Thomas is in fact ionized gas is found in column 3 lines 8, 33 and 35 and also in figures 2, 3 and 4. Further evidence that Thomas discloses plasma, is the use of a remote plasma reactor as stated in column 3, lines 29 and 33:

In this embodiment, however, rather than the atomic oxygen (or atomic oxygen plus atomic nitrogen) being generated within the reactor vessel 54, a remote source 60, e.g., a plasma reactor, generates a flow 62 of atomic oxygen (or O[•] + N[•]), which is provided to the vessel 54.

Appellant further argues that Thomas does not disclose controlling the plasma activity.

Examiner respectfully submits that Thomas discloses in column 3, lines 13 and 14:

The heating elements 24 are controlled to provide a temperature ramp rate of 100 °C per minute or greater.

Thomas controls the temperature at which the plasma (or atomic oxygen) is formed by the controlling of the heating elements. Hence, Thomas discloses controlling the plasma activity.

Appellant also argues that Thomas in view of Moon does not show a limit of rate of oxidation and that the process of Moon is not the same as that of Thomas.

Examiner respectfully submits that Moon teaches a similar process as that of Thomas. In paragraph 0029 Moon teaches the following:

Referring to FIG. 2, the substrate (10) deposited with amorphous silicon layer (13) is exposed to clean air or oxygen gas for at least 6 hours or more favorably 24 hours. In the mean time, oxygen atoms are diffused into the amorphous silicon layer (13') and make loose bond with silicon atom and form a nature oxide layer at the surface of the amorphous silicon layer (13'). As the time pass, the number of silicon-oxygen bond increase but with decreasing ratio and finally stop the increase and that means the surface layer of the amorphous silicon layer (13') is saturated with oxygen atom. FIG. 5 is the graph showing the trend of the respective change of the number of silicon-oxygen bond measured by FT-IR in the amorphous silicon. FIG. 6 is a graph showing the trend of the respective change of the thickness of nature oxide at the surface of amorphous silicon layer measured by ellipsometer spectroscopy.

As shown in Figure 2, one of the oxygen gases is denoted as O^{2-} , which is an ionic species of oxygen much like the ionic species presented by Thomas. Hence, Moon shows their invention is carried much like that of Thomas. Therefore, the teachings of Figure 6 as applied to the rejection is proper since both Thomas and Moon show oxidation by plasma. Furthermore, Moon also discloses the rate of oxidation in paragraph 0031.

The specific time of exposure of amorphous silicon in the air, 6 hours, is decided as a saturation point of oxygen atom in amorphous silicon by the graph in the FIG. 6 acquired by accurate experiment. And the specific time is suggested to have realistic effect in charge mobility. By the careful examination of the FIG. 6 and FIG. 7, the 6 hour is corresponding to the time during which the 20 Å-thick nature silicon dioxide can be formed in the normal air under the premise that the concentration of oxygen atom in silicon dioxide insulation layer is more than 10^{21} atoms/cm³ by the measurement of ultra low energy secondary ion mass spectroscopy. If the thickness of silicon dioxide is smaller than 20 Å, the effect of curing the defect is uncertain. And, considering that some of the oxide layer can be removed by volatilization caused by the laser beam, thickness of oxide of more than 20 Å is needed to secure the cured region. But, at the same time, considering that too thick silicon dioxide layer do harm for the precise re crystallization

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of the amorphous silicon layer, the thickness of the silicon dioxide may well be confined under 100 Å. Usually, there is no need to oxidize the surface of the amorphous silicon layer to 100 Å and it is enough to obtain the effect of the present invention to execute the oxidation until the oxygen atom concentration at the position of 40 Å below the surface of the oxidized amorphous silicon exceed 10^{20} atoms/cm.sup.3.

Examiner respectfully submits that Moon also teaches the rate of oxidation, which is dependant on time, concentration and temperature.

Appellant also argues that Thomas does not teach that the oxidation is controlled by the rate of reaction. Also that Chung does not apply since they are different chemical processes (i.e. Thomas is oxidation and Chung is etching).

Examiner respectfully submits that the reference of Chung was used to show that all reactions, regardless the nature of the reaction, is governed by the kinetics of reaction which is dependant on concentration, temperature and pressure. This is explained in Chung, column 3, lines 46 – 62.

Experimental data shows that at a temperature of 163° – 165° C, a minimum of 10 ppm Cu^{+2} additive is needed to yield an observable enhanced etch rate over that of H_3PO_4 alone. Etch rate data for other additives are shown in Table I for concentrations ranging from 10 – 150 ppm. Some additives are more effective in bringing about enhanced polysilicon etch rates than others. In general, it is expected that ionic species which are capable or participating in a reduction-oxidation reaction with silicon will lead to enhanced silicon etch rate. For example, those species with reduction potentials which are more positive than silicon are likely to exhibit this enhanced silicon etch rate effect. While the use of chemical potentials provides a general guideline in identifying other viable candidates, some deviation from this trend may occur on a case-by-case basis, depending on the reaction kinetics, material thicknesses and specific experimental conditions involved.

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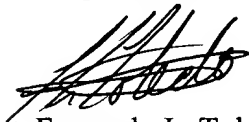
Chung explains how the concentration and temperature will advanced better the reaction of reduction-oxidation of silicon and hence controlling the temperature or concentration of the reactants will affect the kinetics of reaction.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,



Fernando L. Toledo

Patent Examiner

Art Unit 2823

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